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BIBLIOGRAPHY OF RECENT LITERATURE ON FLOTATION OF ORES

JANUARY TO JUNE, 1916

COMPILED BY

D. A. LYON, O. C. RALSTON, F. B. LANEY

AND

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BIBLIOGRAPHY OF RECENT LITERATURE ON FLOTATION OF ORES.

Compiled by D. A. Lyon, O. C. Ralston, F. B. Laney, and R. S. Lewis.

INTRODUCTION.

In January, 1916, the School of Mines and Metallurgy of the University of Missouri issued a bibliography entitled "Concerning Concentrating Ores by Flotation."

That bibliography is comprehensive to the date of issue, but as much literature on flotation is appearing in the technical journals, the Bureau of Mines has thought it advisable to issue a bibliography of the literature from January 1 to June 30, 1916, and to issue further bibliographies of the literature at regular intervals.

This paper includes references to articles that appeared from January 1 to June 30, 1916, in the following periodicals:

Australian Statesman and Mining Standard.
Bulletin of the Institute of Mining and Metallurgy.
Engineering and Mining Journal.
Génie Civil.
Journal of Chemistry.
Journal of Physical Chemistry.
Journal of the Franklin Institute.
Metall und Erz.
Metallurgical and Chemical Engineering.
Metallurgical and Mining Society of South Africa.
Mexican Mining Journal.
Mining and Engineering Review.
Mining and Scientific Press.
Mining Magazine.
Mining World.
Patent Office Gazette.
Proceedings of the American Mining Congress.
Salt Lake Mining Review.
School of Mines Quarterly.
Transactions of the American Institute of Mining Engineers.
Transactions of the Australian Institute of Mining Engineers.
Transactions of the Canadian Mining Institute.
Transactions of the Chemical, Metallurgical and Mining Society of South Africa.
Transactions of the Institute of Mining and Metallurgy.

A few references from miscellaneous publications are also included.

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BIBLIOGRAPHY.

ANDERSON, R. J. The metallurgical disposal of flotation concentrates. Met. and Chem. Eng., vol. 14, Apr. 1, 1916, p. 381. Discusses the handling and smelting of flotation concentrates. Under the handling of concentrates froth breaking, dewatering, and drying are treated. Under the heading "The Smelting of Concentrates" are discussed direct smelting, sintering and smelting, and nodulizing and smelting.

——— Recent progress in flotation. Jour. Franklin Inst., vol. 181, May, 1916, pp. 643–657. Divides flotation processes into three divisions, namely, film flotation, bulk-oil flotation, and froth flotation. Short explanation is given of each. Flotation oils are discussed.

AUSTIN, L. S. The Washoe reduction works, Anaconda. Min. and Sci. Press, vol. 112, Feb. 26 and Apr. 15, 1916, pp. 304–309 and 547. Describes in detail and gives flow sheet of the coarse concentrator and flotation plant and of the slime flotation plant.

AVERY, P. W. Cyanidation of flotation concentrates. Min. and Sci. Press, vol. 112, May 6, 1916, pp. 661–662. A letter discussing the possibility of cyaniding flotation concentrates and describing experiments with oil left in and oil removed. Suggests that alkali and oil may form a "crude soap" which interferes seriously with precipitation. Recommends light calcination before cyanidation.

BALLOT, JOHN. Minerals Separation (Ltd.). Eng. and Min. Jour., vol. 101, Apr. 8, 1916, pp. 641–642. An abstract of an address by John Ballot to the stockholders of Minerals Separation (Ltd.), Dec. 29, 1915. Gives data as to activities of the company throughout the world, tonnage treated, list of some of the large contracts, plans, and royalties.

BANCROFT, W. D. Ore flotation. Met. and Chem. Eng., vol. 14, June 1, 1916, pp. 631–635. Author considers flotation a simple problem and that ore flotation is not a unique phenomenon, but comes under the broad heading of emulsions, and has no law of its own.

BLOCK, J. A. Why is flotation? Min. and Sci. Press, vol. 112, Jan. 22, 1916, p. 115. A short letter to the editor discussing the so-called electrical theory of flotation.

BROWN, D. H. Notes on the metallurgy of copper. Canadian Min. Inst., Bull. 46, Feb., 1916, p. 132. Mentions the effect of flotation on the metallurgy of copper. Concentration being cheaper than smelting makes it a useful method of removing gangue from an ore before smelting. Quotes Callow's cost of 6.7 cents per ton of flotation feed. The advances made in reverberatory smelting show a further saving by the use of flotation concentrates, and hence blast furnace methods will have to be improved or abandoned.

——— Notes on the metallurgy of copper. A review of current literature. Canadian Min. Inst., Bull. 49, May, 1916, pp. 458–464. Contains a review of an article on the metallurgical processes at the Braden Copper Co.'s plant (Eng. and Min. Jour., Feb. 12, 1916), and discusses this company's methods of nodulizing flotation concentrates before smelting. Large nodulizing kilns are used.

CALLOW, J. M. La concentration des minerais par le procédé de flottage pneumatique. Génie Civil, t. 68, Jan. 22, 1916, p. 61. Describes scheme of installation for concentrating minerals by the Callow pneumatic flotation process.

——— Notes on flotation. Am. Inst. Min. Eng., Bull. 108, December, 1915. A brief extract appears in the Salt Lake Mining Review, vol. 17, Mar. 15, 1916, p. 25.

CANADIAN MINING INSTITUTE. Note on flotation. Bull. 5, January, 1916, p. 14. The Zinc Co. (Ltd.), whose officers and directors are the same as those of the Weedon Mining Co., has worked actively the zinc and lead deposits it controls at Notre Dame Anges, Portneuf County. The oil-flotation process, installed during the summer of 1915, is giving satisfactory results.

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CANADIAN MINING INSTITUTE. Note on flotation. Bull. 46, February, 1916, p. 93. States that flotation by the Callow process has been successfully used by the Buffalo Co. at Cobalt in treating tailings, and that other silver mines in this district have begun experiments. The losses in tailings at Cobalt have been relatively low, ranging between 3 and 6 ounces. Heretofore it was considered that these could not be recovered economically.

——— Testing of pine oil for flotation. Bull. 49, May, 1916, pp. 428–430. An illustrated description of a simple method of testing the purity of pine oil which is likely to be adulterated. Of three samples described in the experiments only one was up to the standard.

CLAYTON, C. Y., and PETERSON, C. E. Oils for flotation. Min. and Sci. Press, vol. 112, Apr. 22, 1916, pp. 598–601. Discusses what property or combination of properties makes an oil valuable as a flotation agent. Oils are classified as fixed oils, fatty acids, essential oils, wood oils, coal tars and derivatives, wood tars and derivatives, and petroleum and derivatives. Tables of results with oils of the different groups and a list of experiments with oils are given. Work done was at Missouri School of Mines.

CLENNELL, J. E. Influence of flotation oils on cyanide. Min. and Sci. Press, vol. 112, May 13, 1916, p. 700. A short letter to the editor, giving results of a few experiments on the effect of oils in causing decomposition of cyanide.

CLEVENGER, G. H. Flotation and cyanidation. Met. and Chem. Eng., vol 14, June 15, 1916, p. 674. Discussion of questions put out by Metallurgical and Chemical Engineer.

COGHILL, W. H. On the science of a froth. Min. and Sci. Press, vol. 112, Feb. 26, 1916, p. 314. Explains the physics of frothing in flotation, and the need of a substance in solution that allows the surface film of the liquid to exhibit a variable surface tension.

COLE, DAVID. The electrical theory of flotation. Min. and Sci. Press, vol. 112, Jan. 15, 1916, pp. 79–80. The writer discusses the flocculation of colloidal slimes, and attempts to explain it on the basis of electrically charged particles, using theories advanced by Bain (Min. and Sci. Press, Dec. 27, 1915).

CUNNINGHAM, JESSE. Bibliography; concentrating ores by flotation. University of Missouri, School of Mines and Metallurgy Bulletin, vol. 8, No. 1, 1916, p. 106. A comprehensive list of literature on flotation and closely related subjects, including books, general works, and magazine articles from 1890 to January, 1916, with a list of British and United States patents bearing on flotation.

DELANO, L. A. Flotation practice in Missouri. Min. and Sci. Press, vol. 112, Apr. 29, 1916, p. 633. A description of the plants at the Leadwood, Riverview, and Bonne Terre mills at Flat River, Mo. Flotation is installed to treat slimes from jigs and tables; Dorr thickeners and minerals separation machines used with crude hardwood creosote oil—0.8 pound per ton of pulp. Oliver filters used for dewatering the concentrate. Ore is galena, with a little pyrite, chalcopyrite, and sphalerite, in dolomite, and makes about 15 per cent of slimes.

DURELL, C. T. Flotation principles. Min. and Sci. Press, vol. 112, Feb. 19, 1916, pp. 273–279. A reply by Durell to the numerous critics of former paper on the theory of flotation in Mining and Scientific Press of Oct. 23, 1915.

ENGINEERING AND MINING JOURNAL. Carrie Jane Billings Everson. Vol. 101, Jan. 15, 1916, pp. 129–132. A biographical sketch, with two photographs of Mrs. Everson; mentions her experiments and discoveries in flotation, and gives a copy of her famous flotation patent No. 348,157, Aug. 22, 1886.

——— Differential flotation. Vol. 101, Mar. 25, 1916, p. 551. A short note suggesting a combination of flotation and magnetic separation to separate iron minerals from zinc minerals.

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ENGINEERING AND MINING JOURNAL. Experimental flotation machine. Vol. 101, Apr. 15, 1916, p. 691. Describes briefly the test machine made by Ray & Titcomb (Inc.), at Nogales, Ariz.

——— Flotation at Broken Hill, New South Wales. Vol. 101, Jan. 29, 1916, p. 231. Discusses general results of installation of flotation process in mill of Sulphide Corporation at Broken Hill, New South Wales.

——— Flotation oils at Anaconda. Vol. 101, Mar. 18, 1916, p. 508. A short abstract of that part of Laist and Wiggin's article on flotation at Anaconda dealing specifically with results obtained with different oils.

——— Hydrocarbons for flotation. Vol. 101, Apr. 8, 1916, p. 636. Description of the use of hydrocarbon oils with sulphuric acid as frothing agents. Covered by E. H. Nutter's patent 1,170,665, Feb. 8, 1916. Assigned to Minerals Separation (Ltd.).

——— New ideas about flotation. Vol. 101, Jan. 1, 1916, pp. 22–23. Review of patents granted for variations of the flotation system and apparatus.

——— Rowand's flotation machine. Vol. 101, Apr. 1, 1916, p. 597. A brief illustrated description of a flotation machine devised and patented by L. E. Rowand and assigned to the New Jersey Zinc Co. (U. S. Patent No. 1,159,713.)

——— Testing blankets for Callow flotation cells. Vol. 101, Mar. 25, 1916, p. 562. A short abstract of part of Laist and Wiggin's article on flotation at Anaconda.

——— The Wood flotation machine. Vol. 101, Jan. 22, 1916, p. 175. Discusses the operation of the Wood flotation machine. British Patent No. 10,312.

FAHRENWALD, F. A. The electrostatics of flotation. Min. and Sci. Press, vol. 112, Mar. 11, 1916, p. 375. States that of the various hypotheses thus far advanced to explain the phenomena of flotation only two seem to have a basis sound enough to warrant serious consideration, namely, interfacial tension and the electrical theory. Discusses principally the electrical theory and a few of the facts on which it is based.

FREE, E. E. Rate of slimes settling. Eng. and Min. Jour., vol. 101, Apr. 15, 1916, p. 681. Discusses the factors controlling the settling of slime and gives applications of the principles involved to practical problems.

FUCHS, F. G. Concentration by flotation. Proc. Pan-American Scientific Congress, 1915. (Not yet published.) Deals mainly with experiments to determine how far flotation phenomena are due to, or can be related to capillarity, discussing the adhesive action of oil on different minerals. Experimental and theoretical.

GREENWAY, H. H., and LOWRY, A. H. P. Preferential flotation of minerals from mixed sulphide ores. Met. and Chem. Eng., vol. 14, Apr. 15, 1916, p. 452. An abstract of U. S. Patent 1,102,738.

HAMILTON, FLETCHER. Concentration of quicksilver ores in California. Min. and Eng. World, vol. 44, May 27, 1916, p. 997. States that high extractions have been obtained by water concentration on tables, with friable ores in which the cinnabar is distinctly crystalline. If slimes be produced in crushing and subsequent treatment, the slimed cinnabar can be recovered by flotation. A high extraction has been obtained with finely ground (80-mesh) fresh ores, with either pine oil or eucalyptus oils. The term "fresh" ores is used because, contrary to common conception, cinnabar on exposure oxidizes sufficiently to affect flotation results. Good results were obtained by table concentration of ore-carrying natural quicksilver.

HERSAM, E. A. Flotation and cyanidation. Met. and Chem. Eng., vol. 14, June 15, 1916, p. 675. Discusses questions put out by Metallurgical and Chemical Engineering on this subject.

LAIST, FREDERICK, and WIGGIN, A. E. Flotation concentration at Anaconda. A paper to be presented at the Arizona meeting of the American Institute of Mining Engineers in September, 1916. Am. Inst. Min. Eng. Bull. 111, March, 1916, pp. 549–581. Abstracted in Met. and Chem. Eng., vol. 14, Mar. 15, 1916, p. 328;

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Min. and Eng. World, vol. 44, Mar. 4 and 11, 1916, pp. 471, 522; Eng. and Min. Jour., vol. 101, Mar. 11, 1916, pp. 469–475. Laist and Wiggin, metallurgical manager and superintendent of concentration for the Anaconda Copper Mining Co., relate in detail the flotation experiments at Anaconda, describe the remodeled concentrator as adapted to flotation and the new slime flotation plant.

LAVERS, H. Improvement in preferential flotation. Met. and Chem. Eng., vol. 14, Apr. 15, 1916, p. 452. An abstract of U. S. Patent 1,142,821.

LAWRENCE, B. B. Flotation in Cuba. Min. and Sci. Press, vol. 112, Jan. 22, 1916, p. 135. Gives some data on the performance of the 600-ton flotation plant of the Cuba Copper Co. near Santiago, Cuba.

LAUGHLIN, J. P. M. Flotation processes. Mexican Min. Jour., vol. 21, April, 1916, p. 128. Describes a number of flotation processes and comments briefly on prospects of flotation.

LUND, C. A. Pine oil. Min. and Sci. Press, vol. 112, March 11, 1916, p. 367. A communication objecting to definition given to pine oil in "A Glossary of Flotation," in Mining and Scientific Press (vol. 112, Feb. 12, 1916, p. 228), and discussing the two basic methods of the treatment of resinous woods, namely, the steam and solvent process, and the distinctive distillation process. The specification of the United States Navy Department is given for pine oil, and the statement is made that the definition in the glossary mentioned really covers pine tar oil, as defined by the Navy Department.

MCCLAVE, JAMES. Difficulties encountered in making oil flotation tests. Min. and Eng. World, June 17, 1916, p. 1135.

MAKENZIE, G. C. Treatment of molybdenite ores. Mexican Min. Jour., vol. 21, January, 1916, p. 12. Outlines a process for treating molybdenite ores by crushing and floating.

MARTIN, A. H. The flotation process at Goldfield, Nev. Min. and Eng. World, June 3, 1916, p. 1042. Two hundred tons of ore daily is being treated by the various plants, and it is expected that within three months 650 to 900 tons will be handled every 24 hours. Each plant has shown that it can recover approximately 92 per cent of the gold content and nearly 99 per cent of the copper. At times the gold extraction has exceeded 94 per cent, and the metallurgists believe that the gold recovery may be better than the preliminary tests indicate.

MATHEWSON, E. P. Recent improvements in conditions at the Washoe Reduction Works, Anaconda, Mont. A paper presented at the March. 1916, meeting of the Canadian Mining Institute. Abstracted in Met. and Chem. Eng., vol. 14, 1916, p. 327. Describes this plant as regards the crushing machinery, the Mineral Separation Co.'s flotation machine, and other items.

MEGRAW, H. A. Progress of flotation in 1915. Eng. and Min. Jour., vol. 101, January 8, 1916, pp. 97–99. A brief general summary of the progress of flotation during 1915, including mention of general applicability, ores suitable for treatment, oils, and theoretical principles. A small map of the United States shows the situation of plants using flotation.

METALLURGICAL AND CHEMICAL ENGINEERING. The chemistry of flotation. Vol. 14, June 1, 1916, p. 615. A discussion of the papers presented by G. D. Van Arsdale and Prof. W. D. Bancroft on "The How and Why of Flotation" at the joint meeting of the New York sections of the American Institute of Mining Engineers and of the American Electrochemical Society on May 12, 1916, in New York City.

——— Cost of operating. The Mary Murphy Gold Mining Co. of Colorado. Vol. 14, Apr. 1, 1916, p. 360. Detailed costs of mining and milling are given; also the operating profit for the year.

——— The Everson flotation patents. Eng., vol. 14, Jan. 1, 1916, p. 13. Abstracts from claims set forth in the Everson patents (U. S. Patents 348,157, Aug. 24, 1886, and 471,174, Mar. 22, 1892); with a paragraph on the life of Mrs. Everson.

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METALLURGICAL AND CHEMICAL ENGINEERING. Flotation and cyanidation. Vol. 14, May 15, 1916, p. 569. A symposium on the cyanidation of flotation products and the influence of flotation on the relative importance of cyanidation as a metallurgical process. Replies to a questionnaire. Those replying were J. M. Callow, James Johnston, R. W. French, Philip Argall, Edwin Letts Oliver, Walter Neal, Henry E. Wood, Charles W. Merrill, Bernard MacDonald, Thomas B. Crowe, Charles A. Chase, and Charles E. Locke.

——— Flotation symposium. Vol. 14, May 15, 1916, p. 572. An account of the joint meeting of New York sections of American Institute of Mining Engineers and American Electrochemical Society. Two principal speakers were G. D. Van Arsdale and W. D. Bancroft.

——— Flotation test tank for mill or laboratory. Vol. 14, January 15, 1916, p. 112. Describes a laboratory Parral tank for making a flotation test. Descriptive pamphlet may be obtained by writing to Parral System of Tank Agitation, I. W. Hellman Building, Los Angeles, Cal.

——— Improvement in flotation. Vol. 14, Apr. 1, 1916, p. 399.

——— Preferential flotation of galena and blend. Differential flotation at Broken Hill. Vol. 14, Mar. 1, 1916, p. 279. Abstract from Min. and Eng. Rev., Melbourne. Discusses treatment of tailings from lead mill of the new zinc plant erected by the Sulphide Corporation at its central mine, Broken Hill, New South Wales, the process being as follows: All lead possible is removed by agitation of pulp in Hebbard-Harvey underslime machine (used in place of original Mineral Separation apparatus) with small quantity of eucalyptus or other suitable oil. Feed averages 4.2 per cent lead and 18 per cent zinc; lead concentrates assay 57 per cent metal. Steam has been discarded altogether and process is worked cold. Possible to extract an additional 15 per cent of lead and silver as compared with process previously used.

——— Theories of the flotation process. Vol. 14, Jan. 1, 1916, pp. 49–51. An abstract from Callow's paper presented at the Salt Lake City meeting of the American Institute of Mining Engineers and published in Am. Inst. Min. Eng. Bull. 108, 1915, pp. 2321–2340.

——— Value of continuous operation in ore testing. Vol. 14, Mar. 15, 1916, p. 292. Calls attention to fact that in making preliminary tests, by the agitation froth method, for example, it is customary to use a small single-cell machine and a few ounces of ore, the pulp being kept in a closed circuit until no more froth is obtained. Such tests give an approximate idea of the efficiency of oils, and the general applicability of the process. On the other hand certain factors are not determined by such tests with a single-charge system. The latter will not reveal the effect of continuous return of middling on the grade of concentrate, nor will it show the effect on oil consumption of the use of recovered water. Therefore continuous testing on a small scale is advocated in order to observe the cumulative effect of certain factors and to permit correct deductions.

MEXICAN MINING JOURNAL. The flotation concentration of ores. Vol. 21, Feb., 1916, p. 45. Reprint from the Mineral Industry, 1914, giving information regarding the practice followed at a number of different plants.

——— Flotation in gold metallurgy. Vol. 21, 1916, p. 90. Abstracts from the paper of W. B. Blyth in Bull. 16, Australian Inst. of Min. Eng.

——— Flotation will not supersede quite all other processes. Vol. 21, Jan., 1916, p. 3. Notes the tendency to demand too much of the flotation process and to consider it a process applicable to all ores. Flotation is not likely to drive out the cyanide process as a primary treatment. nor to displac gravity concentration for coarse-grained ores.

——— Oils for flotation. Vol. 21, Jan., 1916, p. 3. Marked improvements in the flotation process will doubtless be in the selection of the best oil for a particular ore and in cheapening the cost of oils.

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MINING AND ENGINEERING REVIEW. Electrolytic zinc; the bearing of the flotation process. Vol. 8, May, 1916, pp. 196–197. Discusses the uncertainty of the effect of flotation on the metallurgy of zinc. States that the treatment of flotation concentrate, because of excessive fineness, is one of the present problems of the zinc smelter.

——— Flotation. Vol. 8, January, 1916, pp. 91–92. Discusses lack of adoption of flotation process in Australia.

——— Flotation at Anaconda. Vol. 8, May, 1916, pp. 200–201. Review of paper by Frederick Laist and A. E. Wiggin, published in March bulletin of American Institute of Mining Engineers.

——— Flotation terminology. Vol. 8, May, 1916, pp. 187–188. Explains terms used in describing flotation methods.

——— United States Patent 1,164,653, issued to J. H. Klepinger, M. W. Krejci, and C. R. Kuzell, Process for smelting flotation concentrates. Vol. 8, May, 1916, p. 200. Said to accomplish roasting and matting in a single operation.

MINING AND ENGINEERING WORLD. Breaking down froth in flotation work. Vol. 44, May 20, 1916, p. 951. States that flotation will not supplant the cyanide process because flotation is a method of concentration, whereas cyaniding is a method of extraction. Briefly mentions drawbacks met in breaking down froth with water, and discusses the Thompson and Cole process (U. S. Patent 1,180,889), which is designed to act in much the same way as water streams, but employs a gas jet containing drops of a liquid, such as water.

——— Keep flotation agitation where it belongs. Vol. 44, February 19, 1916, p. 405. Objects to adverse criticism regarding the contract that the Minerals Separation Co. makes with its engineers.

——— Treatment of mill tailings in Arizona. Vol. 44, May 27, 1916, p. 1004. Randolph-Gemmill Development Co., Prescott, Ariz., is successfully treating the tailings which accumulated 12 to 15 years ago at the Crown King Mill as the result of jig and table concentration of the complex Gold King ore. The tailings carry gold, 0.3 ounce; silver, 4½ ounces; iron, 10 per cent; zinc, 11 per cent; copper, 0.8 per cent; insolubles, 53 per cent. A 4 to 1 bulk concentrate is made over tables and by oil flotation, each 100 tons of tailings yielding a bulk concentrate of 25 tons. The latter is retreated, the zinc and iron being separated, and yields 9 tons of zinc product and 16 tons of iron concentrates. The zinc product carries 45 per cent zinc, 10 per cent iron, 4½ per cent copper, 13 ounces silver, and 0.35 ounce gold; the iron product runs 0.8 ounce gold, 12 ounces silver, 15 per cent zinc, 18 per cent iron, 3 per cent copper, and 25 per cent insoluble.

MINING AND SCIENTIFIC PRESS. Carrie J. Everson and flotation. Vol. 112, January 15, 1916, p. 82. A short biographical account of Mrs. Everson and her discoveries in flotation.

——— Concentrating molybdenum. Vol. 112, January 15, 1916, p. 82. A short abstract of an article on the same subject in the Canadian Mining Journal. The methods recommended by the Canadian Department of Mines are outlined.

——— Concentrating ores of quicksilver. Vol. 112, May 27, 1916, p. 796. A general discussion, including statements as to type and cost of furnaces. Says that cinnabar can be and has been successfully concentrated by flotation.

——— Flotation at Humboldt, Ariz. Vol. 112, Jan. 8, 1916, p. 41. Gives some figures regarding extraction and costs of flotation at the mill of the Consolidated Arizona Smelting Co., Humboldt, Ariz.

——— Flotation litigation. Vol. 112, Jan. 29, 1916, p. 153. Discusses Minerals Separation Co.'s suit against Butte & Superior Copper Co.

——— A flotation machine. Vol. 112, April 15, 1916, p. 563. States that at the mine of the Suan Concession, in Korea, a flotation apparatus is used to check small-scale tests for removing chalcopyrite from scheelite. The capacity is 100 pounds of crushed ore per hour. The total cost, including motor, is less than $50. A drawing of the machine is shown.

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MINING AND SCIENTIFIC PRESS. Flotation tests on Arizona ores. Vol. 112, Jan. 15, 1916, p. 97. A short statement on experimental work in flotation being done at the University of Arizona at Tucson. The machine used is of the modified Hoover type, and especial attention has been paid to separating copper and iron sulphides from molybdenite. Good results have been obtained with eucalyptus and creosote oils, even with mixtures as low as 0.05 per cent oil.

——— A glossary of flotation. Vol. 112, February 12, 1916, p. 228.

——— Physics of flotation. Vol. 112, 1916, p. 260. Suggests that in schools of mining the students make use of the instruction and laboratory facilities afforded by the physics department, and do not attempt to study flotation problems under the direction of professors of geology, mining, or metallurgy alone.

——— A professional matter. Vol. 112, February 5, 1916, p. 190. Editorial comment on contract made by Minerals Separation Co. with its engineers.

——— The psychology of flotation. Vol. 112, Mar. 4, 1916, pp. 331, 332. Brief editorial discussion of the history of the various flotation processes, stating that any attempt to understand "the scanty and contradictory literature of the flotation process is bound to be unsuccessful without the help of some knowledge of those personal equations that have rendered the subject so perplexing."

——— Smelting flotation concentrates. Vol. 112, Feb. 12, 1916, p. 243. A brief outline of the treatment of flotation concentrate of the Braden copper, Chile. The plant treats 350 tons daily, obtained from 4,000 tons of concentrates. The flotation concentrate carries 19 per cent copper, 17 per cent silica, 23 per cent iron, 2 per cent lime, 8 per cent alumina, and 28 per cent sulphur, is sandy and limy, and contains 20 per cent water. The treatment of the concentrate is as follows: About 215 tons is dried and nodulized in kilns heated by oil burners to a temperature of 1,750° F. This reduces the sulphur content to 18 per cent and evaporates moisture. Otherwise nodules have about same chemical content as original concentrate. Nodulized product goes to the blast furnaces. Another 50 tons of concentrate goes to a sinter plant, where the sulphur is reduced to 12 per cent and a hard coke is produced, which is sent to the blast furnaces. The remaining 85 tons of concentrate goes directly to the blast furnaces. Thus 62 per cent is nodulized, 14 per cent sintered, and 24 per cent of the concentrate is reduced direct.

——— Testing for flotation. Vol. 112, Jan. 8, 1916, p. 35. Comments on this phase of flotation.

MINING CONGRESS JOURNAL. Flotation process now used at important Utah mines. Vol. 2, March, 1916, p. 116. Brief general statements on the adoption of flotation by large mining companies in New Mexico, Arizona, and Utah.

——— Four problems are involved in applying flotation to Joplin ores. Vol. 2, April, 1916, pp. 189–190. A short discussion of the work of the Bureau of Mines in the Joplin district. The four problems are: Quantity of material treatable without further crushing, possibility of regrinding material, most suitable oils, and the effect of the acid waters in some of the mines.

——— Importance of flotation in metallurgy too vast to estimate. Vol. 2, May, 1916, pp. 242–244. A reprint of Bureau of Mines circular on flotation. Discusses types of flotation processes, origin, application, and importance of flotation, and gives a selected bibliography.

——— Increasing importance of molybdenum ores leads to special report. Vol. 2, April, 1916, pp. 157–159, 200–201. Abstract from a forthcoming bulletin by F. W. Horton of the Bureau of Mines. Discusses briefly the applicability of flotation to ores containing molybdenite, stating that such ores are more readily amenable to flotation than to any other method of concentration.

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MINING CONGRESS JOURNAL. Salt Lake City greatest flotation center in United States. Vol. 2, February, 1916, pp. 65–66. Brief statements on the importance of Salt Lake City as a mining center and the work in flotation done by the General Engineering Co. (Callow machines), the Utah Copper Co. (Janney machines), and by the University of Utah under the direction of the local station of the Federal Bureau of Mines.

MINING MAGAZINE. Callow's flotation method. Vol. 14, January, 1916, p. 48. A review of the paper of J. M. Callow in the December, 1915, bulletin of the American Institute of Mining Engineers.

——— Concentration and metallurgy at the Falcon mines. Vol. 14, March, 1916, p. 119. Describes concentration at the Falcon mines, east of Gwelo, Rhodesia, in which a copper-gold ore is treated on tables and by flotation with Minerals Separation machines. Difficulties in smelting the flotation concentrate are mentioned.

——— Cyanide treatment of flotation concentrate. Vol. 14, January, 1916, p. 50. A review of the paper of Charles Butters and J. E. Clennell in the Mining and Scientific Press of November 20, 1915.

——— Flotation in the Miami lawsuit. Vol. 14, January, 1916, p. 46. A review of the arguments presented in the suit of Minerals Separation (Ltd.) *v.* Miami Copper Co., before the United States district court of Wilmington, Del. New evidence, not presented in the Hyde case, was brought out. Says it is an open secret that the case will be appealed. Minerals Separation claimed a new effect in the use of less than 1 per cent of oil, calling the result an "air froth," any previous froths regarded as "oil froths."

——— Minerals Separation. Vol. 14, January, 1916, p. 11. A comment on the tenth annual meeting of the shareholders of the Minerals Separation (Ltd.), just before Christmas, 1915. John Ballot, the president, gave many interesting figures. In the United States in 1914 the increase of spelter production due to flotation was 46,000 tons, and in 1915 about 110,000 tons. Licensees of the company in the United States in 1915 milled 4,500,000 tons, and by the end of 1916 it is expected that they will be milling at the rate of 13,000,000 tons. A hundred or more companies are also operating without license. Minerals Separation closed the year in good financial condition although a larger part of the money earned was expended in lawsuits. Dividends for the year 1916 were suggested.

——— New theories of flotation. Vol. 14, January, 1916, p. 47. A review of papers by Durell, Ralston, Callow, and Bain.

NORRIS, D. H. Molecular forces in flotation. Surface compression. Min. and Sci. Press, vol. 112, Feb. 26, 1916, pp. 232, 236. Explains in a popular way what surface tension and surface compression are, and gives a number of useful analogies by which to form a mental picture of the result of molecular forces acting in the surface of a liquid. Suggests that a number of writers on flotation have failed to understand what surface tension is.

OWEN, T. H. Preferential flotation of galena and blende. Met. and Chem. Eng., vol. 14, Apr. 15, 1916, p. 452; Min. and Sci. Press, vol. 112, Jan. 8, 1916, p. 60. An abstract of U. S. Patent 1,157,176.

PARMELEE, H. C. Carrie Jane Everson and the flotation process. Met. and Chem. Eng., vol. 14, Jan. 15, 1916, pp. 67–69. A biographical sketch, with two photographs, of Mrs. Everson and an account of her experiments and discoveries in flotation. Discusses both Everson patents (U. S. patents 348,157 of Aug. 22, 1886, and 471,174, of Mar. 24, 1892), and the experiments leading up to them.

——— Flotation process at the standard mill, Silverton, B. C. Min. and Eng. World, vol. 44, June 17, 1916, p. 1121. The ore, mainly silver-bearing galena and zinc blende in a gangue of pyrite and quartz, is treated in a Wyman pneumatic flotation machine. The operation of the plant is described and likewise the Wyman machine.

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PARSONS, A. B. Flotation at Silver King and Daly-Judge. Salt Lake Min. Rev., vol. 17, Feb. 29, 1916, p. 11. Gives flow sheets and descriptions of these mills, both of which supplement gravity concentration by floating the slimes.

PEARCE, J. A. Flotation versus cyanidation. Met. and Chem. Eng., vol. 14, June 15, 1916, pp. 706–708. Discusses some interesting parallel tests carried out at the Argo mill, Idaho Springs, Colo., to show the relative merits of flotation and cyanidation for pyritic ores.

RALSTON, O. C. The control of ore slimes. Eng. and Min. Jour., vol. 101, April 29, 1916, pp. 763–769; May 20, 1916, pp. 890–894; June 3, 1916, pp. 990–994. Discusses the application of colloid chemistry to slimes and shows that a thorough knowledge of slimes is necessary to enable the mill operator to treat them to good advantage.

——— Flotation in 1915. Met. and Chem. Eng., vol. 14, Jan. 1, 1916, p. 2. A short discussion of causes of flotation; the commercial situation as regards oils; the function of oil in flotation; the use of various coal-tar products and other modifying agents; and the relation of flotation to cyanidation.

——— Flotation principles. Min. and Sci. Press, vol. 112, Apr. 29, 1916, pp. 621–623. A reply to the paper of C. T. Durell in the Mining and Scientific Press of Feb. 15, 1916, as well as similar papers published in the Colorado School of Mines Magazine for February, 1916, and reprinted in Metallurgical and Chemical Engineering, vol. 14, 1916, p. 50. Durell's hypothesis of nascent gas and occluded gas being necessary in flotation is attacked, and experimental evidence to disprove it is presented.

——— Statement on flotation oils. Bureau of Mines Circular, May, 1916. A circular intended for answering letters of inquiry; discusses the market conditions of flotation oils, and the oils best adapted for different ores. A list of producers is appended, and the average costs of the different oils are stated. The rate of consumption of flotation oils at the beginning of 1916 and the probable consumption by the end of the year are discussed.

RALSTON, O. C., and ALLEN, G. L. Testing ore for the flotation process. Min. and Sci. Press, vol. 112, Jan. 1, 1916, p. 8. Discusses in detail various flotation testing apparatus and describes methods of making laboratory tests.

RESZVENY-TARSASAG, H. M. V. Process and apparatus for the treatment of slimy ores by flotation. German Patent 288,390 of Dec. 18, 1913, issued Nov. 1, 1915; Metall und Erz, vol. 13, January, 1916, p. 12. For treating pulps containing over 30 per cent of slimes the ordinary flotation process is not economical, because three to four hours of agitation is required. In most flotation plants the practice is to keep the pulp in the machines only two or three minutes before it flows to the spitzkasten. In the apparatus proposed an impeller in the bottom of a circular kettle-shaped agitation vessel stirs in air from a jet of compressed air under the impeller. The top of the machine is boxed in, there being only a small outlet in the center for froth and baffles, and is so arranged that the pulp immediately under this outlet is quiescent.

RICHARDS, R. H. Evolution of ore-dressing methods. Mexican Min. Jour., vol. 21, January, 1916, p. 18. A paper presented at the International Engineering Congress, Sept. 20–25, 1915. Briefly refers to some principles of the flotation process.

RICKARD, T. A. The Everson myth. Min. and Sci. Press, vol. 112, Jan. 15, 1916, p. 78. States that he believes the Everson patents to be of little or no value in metallurgy, and that the flotation of to-day came down from George Robson, of Wales, through the Elmores, Froment, Sulman, and Picard.

——— The flotation process. Min. and Eng. Rev., vol. 8, May, 1916, p. 205.

——— The flotation process. 1916. 364 pp. Reprint of 37 articles published in Mining and Scientific Press from July, 1915, to early in 1916.

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RICKARD, T. A. The flotation processes. Canadian Mining Institute Bull. 47, March, 1916, pp. 226–272; Min. and Sci. Press, vol. 112, Mar. 4, 1916, pp. 333–336; vol. 112, Apr. 1, 1916, pp. 407–413, 467–474. Divided into three parts, as follows: Part 1 (Physics) gives a brief discussion of the physics of oil flotation and with the part that oil plays in the process, etc. Part 2 (Processes) briefly reviews the development and introduction of the various oil flotation processes. Part 3 (Patents) discusses the reasons for the litigation that has so hampered the development of the process. Some of the most important patents are briefly discussed.

——— Philip Argall, and metallurgical progress. Min. and Sci. Press, vol. 112, Jan. 22, 1916, p. 119. Report of an interview in the form of questions and answers. Touches on flotation.

——— Simple problems in flotation. Min. and Sci. Press, vol. 112, Feb. 19, 1916, p. 263. Discussion of Durell's objection (Min. and Sci. Press, vol. 112, Feb. 19, 1916, p. 273) to his statement in regard to the floating of an ungreased needle. Describes experiments that he made in connection with floating a needle, and discusses experiments of Durell and Norris who poured kerosene on colored water and blew air into the water.

RIGG, GILBERT. A dissertation on flotation. Eng. and Min. Jour., vol. 101, Feb. 26, 1916, pp. 383–385. A humorous address at the American Institute of Mining Engineers' smoker, New York City, Feb. 16, 1916.

RITTER, E. A. Recent milling practice in San Juan County, Colorado. Min. and Eng. World, vol. 44, Jan. 15, 1916, pp. 109–115. An illustrated article discussing the installation of flotation departments as auxiliaries in most of the mills in the San Juan district. Mentions types of machines, methods of crushing, capacity, oils used, and other items of interest.

ROSENBLAT, G. B. Direct drive for flotation machines. Min. and Eng. World, vol. 44, May 20, 1916, p. 957. Discusses efficient and simple methods of applying direct the power required for revolving the paddles in cells using mechanical agitation.

SALT LAKE MINING REVIEW. Flotation research at University of Utah. Vol. 17, Apr. 15, 1916, p. 21. Explains the work being done at the University of Utah in cooperation with the United States Bureau of Mines.

SHELLSHEAR, W. Selling lead and zinc concentrates; how the flotation process increases profits. Min. and Eng. Rev., vol. 8, May, 1916, pp. 190–191. States that flotation surpasses all other methods of concentration in that it is the only metallurgical process in which the grade of the concentrate is practically independent of the grade of the crude ore. Obtaining an accurate average sample of material under examination is important. The higher the grade of ore the higher will be the recovery obtained by metallurgical processes. Allowance must be made for the fact that ore structure varies in the different stopes of a mine.

SMITH, R. Schwimmaufbereitung anstatt Cyanidlaugerei. (Flotation instead of Cyanidation.) Metall. und Erz. Bd. 13, Mar. 22, 1916, p. 156.

SMITH, R. W. Flotation replaces cyanide. Eng. and Min. Jour., vol. 101, Jan. 15, 1916, pp. 142–144. Presents details as to methods and costs of changing an unsuccessful cyanide plant at the Oneida Stag mine, near Idaho Springs, Colo., to a successful flotation plant, together with flow sheets and tables of savings by each process.

STANDER, H. J. Interfacial tension in flotation. Eng. and Min. Jour., vol. 101, Mar. 25, 1916, pp. 576–577. Explains the action of oils and acids in flotation based on surface electric charges and interfacial tension or the relative surface tension and adhesion of the substances used.

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THOMSON, F. A. Principles involved in flotation concentration. Min. and Eng. World, vol. 44, Feb. 19, 1916, p. 392. States how the mineral particles are floated and explains the operation of flotation machines.

THRONBERRY, M. H. Soap as a frothing agent in flotation. Min. and Sci. Press, vol. 112, May 13, 1916, pp. 715–716. A record of a number of experiments with various oils in a modified minerals separation machine (laboratory size), using soap solutions of varying strengths as frothing agent, ore being galena (5.03 per cent Pb), in dolomite. Results show that soap may be used, but the extractions given are all low, and coarse galena is lost in the tailings.

THURSTON, M. R. The Lewis mill at Battle Mountain. Salt Lake Min. Rev., vol. 17, Jan. 30, 1916, p. 14. Briefly describes general features of the new 100-ton flotation plant erected by Battle Mountain Mines & Development Co. for treating silver ores.

TUPPER, C. A. Flotation—its progress and its effect upon mill design. Min. and Eng. World, vol. 44, Jan. 1, 1916, pp. 1–14. Reviews recent progress of flotation in Montana, Arizona, Colorado, Utah, Idaho, Nevada, New Mexico, Washington, Michigan, California, British Columbia, and South America, and gives views of some of the plants, including a flow sheet of the National Copper Mining Co.'s plant at Mullan, Idaho.

VAN ARSDALE, G. D. How flotation works. Eng. and Min. Jour., vol. 101, May 13, 1916, p. 851. States that "there is no flotation without a surface film," and that all methods of flotation are reduced, by analysis, to dependence on the surface tension of a liquid in contact with a gas.

WALSH, FRED. Improvement in flotation. Australian Statesman and Min. Stand., vol. 55, Feb. 3, 1916, p. 108, abstracted in Min. and Eng. World, vol. 44, Apr. 29, 1916, p. 830. Describes an improvement in flotation by the agitation-froth process. Colloidal gangue matter in a pulp is frequently a serious impediment to the successful concentration of fine sulphides, and the presence of a very high proportion has prevented profitable treatment by flotation. Seemingly suspended colloidal matter renders ineffective the frothing agents. Walsh proposes to add to the pulp a small quantity of an electrolyte of low dissociation constant, such as a weak hydrion-producing electrolyte, or salts of weak organic acids, such as crude acid potassium tartrate. Tartaric or citric acid also is claimed to produce the desired effect. The electrolyte must not precipitate the colloids so as to coagulate mineral slime with gangue slime. Where sulphuric acid is used in flotation the electrolyte may be introduced before that acid, for example, in the grinding of the pulp; but such an electrolyte may be effectively employed where sulphuric acid is not used, and with or without oil or any other agent.

WOOD, H. E. The concentration of Canadian molybdenite ores. Canadian Min. Inst., Bull. 47, March, 1916, pp. 73–290. Describes the film flotation machines invented by Wood and the results of a number of tests of Canadian ores.

WRIGHT, C. I. Minerals separation contracts and metallurgists. Min. and Sci. Press, vol. 112, Feb. 5, 1916, p. 193. Gives a copy of the contract between the company and its engineers and an opinion upon the legality of the contract.

UNITED STATES PATENTS RELATING TO FLOTATION.

BACON, R. F. Flotation of minerals. U. S. Patent 1,180,816, Apr. 25, 1916. Oxidized ores, finely divided, are converted into sulphides by a soluble sulphide, such as hydrogen sulphide, and then submitted to any familiar process for separating sulphides from gangue.

CALLOW, J. M. Ore-flotation apparatus. U. S. Patent 1,182,748, May 9, 1916. Apparatus comprises a tank with specific means for keeping the heavy particles of pulp in motion or suspension, thereby preventing their settling on the surface of a porous medium through which is admitted a gaseous fluid under pressure.

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CALLOW, J. M. Separatory apparatus and process. U. S. Patent 1,176,428. Assigned to Metals Recovery Co., Augusta, Me. The flotation separatory apparatus embraces a tank having a bottom restrictedly open to the atmosphere, the tank being adapted to contain comminuted ore and water and a frothable agent, and means for producing suction in the tank to draw air through its bottom to generate bubbles and to destroy the bubbles and remove the mineral particles floated thereby.

GAYFORD, EARNEST, and CRERAR, GEORGE. Process of concentrating ores. U. S. Patent 1,176,441. Assigned to Metals Recovery Co., Augusta, Me. Consists essentially in reducing, by successive stages, ore mixed with water and a frothable agent having a preferential affinity for metalliferous matter, aerating the mixture from each reduction, and floating off the concentrate liberated at each reduction.

HOWARD, A. H. Ore concentration. U. S. Patent 1,170,637, Feb. 8, 1916. Employs as frothing agents the products obtained by treating organic bodies such as fats, oils, alcohols, phenols, and their homologues with sulphuric acid.

JANNEY, T. A. Ore-concentrating apparatus. U. S. Patent 1,167,076, Jan. 4, 1916. Involves repeated circulation of ore pulp in each of two units and simplified connections between units.

KOLLBERG, F. B., and KRAUT, MAX. Flotation machine. U. S. Patent 1,174,737, Mar. 7, 1916. Invention consists generally of a spraying drum or cylinder for the spraying chamber of the machine and of means for controlling the air supply to this chamber.

MORRIS, D. H. Apparatus for separating the metallic and rocky constituents of ores. U. S. Patent 1,167,835, Jan. 11, 1916. Describes apparatus for introducing aerated water into a flowing mixture of ore and water at several different levels or points intermediate between the inlet and the outlet of the container.

NUTTER, E. H. Concentration of ore. U. S. Patent 1,170,665, Feb. 8, 1916. Covers improvements in froth flotation processes.

STONE, G. C. Flotation apparatus. U. S. Patent 1,156,041, Oct. 5, 1915. Assigned to New Jersey Zinc Co. This machine provides for introducing small charges of ore into the flotation liquid intermittently with negligible agitation of the liquid.

THOMPSON, A. W., and COLE, DAVID. A method of breaking down flotation froth. U. S. Patent 1,180,089, Apr. 18, 1916. The stream of froth in a launder is passed under a nozzle from which issues a whirling jet of air into which water is introduced axially, so that the water is divided into spherical drops which impinge on the froth and break the froth bubbles.

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BULLETIN 70. A preliminary report on uranium, radium, and vanadium, by R. B. Moore and K. L. Kithil. 1913. 100 pp., 2 pls., 2 figs.

BULLETIN 73. Brass furnace practice in the United States, by H. W. Gillett. 1914. 298 pp., 2 pls., 23 figs.

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BULLETIN 41. Government coal purchases under specifications, with analyses for the fiscal year 1909–10, by G. S. Pope, with a chapter on the Fuel-inspection laboratory of the Bureau of Mines, by J. D. Davis. 1912. 97 pp., 3 pls., 9 figs. 15 cents.

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